THE MICROSCOPE

THE VALUE OF NITRATE OF SILVER AS A REAGENT FOR DEMONSTRATING MINUTE STRUCTURE.—Since Von Recklinghausen drew attention to the beautiful results to be obtained by the use of a weak solution of nitrate of silver, in the study of the finer distribution of vessels, and especially of the lymphatics, much discussion has taken place as to the trustworthiness of results obtained by this method, and there are some histologists of merit who maintain that the whole thing is false and delusive in its effect. The method consists in immersing perfectly fresh (warm from the animal) tissues in a ½ per cent. aqueous solution of nitrate of silver, leaving them there for from five to ten minutes, and then, after thorough washing, mounting in glycerine, and exposing to sunlight for half an hour, or two or three hours as the case may be. If desired, the tissue may be plunged while fresh into serum (preserved with just a trace of iodine), and after two hours' maceration therein may be smoothed with a small paint-brush, to remove superficial epithelium (as, for instance, in the centrum tendineum of the guinea-pig), and then placed in the silver solution. It is, however, preferred by Dr. Klein, of Vienna, to brush away the superficial epithelium of the thoracic surface, if the lymphatics of the centrum tendineum are to be examined, before removing the diaphragm from the body, whilst perfectly fresh and warm, warm water being used for this purpose, and a camel's-hair paint-brush: immediately after this "pencilling" the centrum tendineum is cut out and placed in the nitrate of silver solution. In the same way, in researches on the cornea the conjunctival epithelium may be removed in the living animal and the silver solution then applied. Dr. Klein, Professor Stricker's assistant, has found that the best results were to be obtained with the cornea, by removing the conjunctival epithelium, and rubbing the corneal surface well with lunar caustic, and removing the cornea in half an hour's time. This method proves admirable with frogs, and is probably applicable to other corneæ. The results of the nitrate-of-silver-staining as seen in the centrum tendineum, are that both thoracic and peritoneal epithelium (where not pencilled away) are stained, the outlines of the cells being brought out very distinctly. In addition to this the epithelium lining the vessels which run in the centrum is also brought out, and especially the curiously crenated epithelium of the fine lymphatics is demonstrated. Moreover, Recklinghausen pointed out that small branched cavities become delineated connected by their branches to one another, and opening into the lymphatics with the crenate epithelium. These lacunar channels, "the juice canals," are brought into view by the action of the silver in staining the substance of their walls but leaving the cavity free. A *successful* silver preparation of the centrum tendineum of a guinea-pig, for instance, shows these structures clearly, but it is not always possible to succeed. Besides the remarkable epithelium of the lymphatics and the juice-canals, a hexagonal pavement of enormous cells is demonstrated on the nerve sheaths, and an exceedingly fine cell pavement on the adventitia of the small veins in some beautiful silver preparations of the "centrum" made by Dr. Burdon Sanderson. The results in the cornea are very remarkable, for the whole substance of that tissue in the frog is demonstrated to be filled with oblong radiating cavities, communicating with one another by their branches, and of so angular and regular a character as to give the appearance of a mosaic-work or some such elaborate device. These cavities correspond to the juice-canals in the centrum tendineum, it is by their means that the cornea is nourished, it is they which contain the large star-like cells or protoplasm-masses brought out by gold chloride, and it is along their branches that the divided portions of these cells wander so remarkably in the process of inflammation. And now we are told by some persons that these are artificial productions, that the juice-canals and the radiate lacunæ, and the crenate lymphatic epithelium too, are due to fortuitous coagulation caused by the silver, that they do not represent structures existing in life. There are two sets of objectionists, some who deny the whole thing, others who go so far as to deny the juice-canals and stellate lacunæ, but admit the epithelium. An exponent of the first order is a certain Dr. Robinski, who in a paper published in the excellent *Archives de Physiologie* of Brown-Séquard, pretends that the crenate epithelium which so many have seen in the finer lymph vessels, as well as the juice-canals, are due to imperfect retention of portions of the superficial epithelium, and gives a drawing intended to show this. The author of the paper has simply failed utterly and entirely in using the method, and the outrageous view which he advances does not require refutation. Everyone knows who has made silver preparations successfully that the thoracic, the lymph-canal, and the peritoneal epithelium may all be seen lying one over the other in parts of a preparation, and that the form of the second prevents its being mistaken for the first or third. Others maintain that the crenate lymph-epithelium is simply a form due to the silver, and not to cells at all. This is impossible, because the nucleus and cell-contents are sometimes clearly demonstrated, and moreover the same form of epithelium may be readily obtained from large lymph-sacs, of some of which it is characteristic. The juice-canals, if they appear doubtful at all when taken by themselves (which indeed they do not if a *good* preparation is examined), when seen in the light of the stellate lacunæ of the frog's cornea, are clearly understood, and must be fully admitted as normal living structures. There are, however, persons who object to these, among whom is so eminent a histologist as Professor Schweigger-Seidel, and also that accomplished micrographer, Dr. Ranvier, of Paris. They actually hold that these forms are *post-mortem* products, the effect of the action of nitrate of silver on the albumen and gelatine of the tissue. It is almost as strong a position to take up as that of certain schoolmen who maintained that we know nothing of the anatomy of living animals, since the air admitted on cutting them open, and the scissors, produced all the various viscera seen in a dissection. There are some strong facts which we have witnessed which render such a view untenable. In the first place, the stellate lacunæ of the frog's cornea are shown in a preparation in our possession, with the intermediate substance stained by *gold* and the lacunæ and cells unstained, in fact, exactly the same appearance as is produced with silver. Hence the stellate form of the lacunæ cannot be due to a specific action of the silver. Again, by silvering the living cornea whilst it is still part of the frog, the structure is brought out, and may be obtained of all degrees of intensity, the *form*, however, always remaining the same, and not varying with the amount of silver allowed to act on it, as might be expected had we to do with a precipitation-form, which should appear less completely developed when less silver is used. Moreover, the living cells were thus demonstrated lying in these stellate lacunæ, creeping up the radiating branches, drawing back again, and creeping along others, thus obtaining that curious direction to their movements which one always observes in studying them in the fresh, unstained, inflamed cornea. The necessity of admitting that the normal structure of the frog's cornea is brought out by the silver method, covers also the question as to the similar structures in the centrum tendineum. The "Saft-canälchen" must equally be admitted as having a living existence, and are not due to the imaginary precipitating action of nitrate of silver on some albuminoid, as Schweigger-Seidel would have us believe, but a parallel to which he cannot find. The chief difficulty with regard to the crenate epithelium of the lymph vessels in the centrum tendineum is to explain why we only see one layer of these cells; they should appear all round the wall of the vessel so as to produce a double layer as we look through it, but we only see one layer, the other not being stained. The action of light, the absorption of the silver, and other causes, may be hazarded as explanations of this; but it would be satisfactory to get a double layer clearly shown.

So far, then, from agreeing with Schweigger-Seidel and other objectors, that the silver method of Von Recklinghausen "gives no true indication of the structure of the cornea," nor of similar structures, and "should be abandoned,"* we believe that when carefully applied it furnishes most admirable results, difficult to attain in any other way at present in our hands, and is worthy of all confidence, and should be used as a means of investigation in other structures besides those to which it has been already applied.

E. R. L.

REPORT OF THE KEW COMMITTEE OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE FOR 1869-70

THE Committee of the Kew Observatory submit to the Council of the British Association the following statement of their proceedings during the past year:—

At the meeting of the General Committee at Exeter it was resolved that the existing relations between the Kew Committee and the British Association be referred to the Council to report thereon. In consequence of this resolution, the Kew Committee, on the 23rd November, 1869, prepared for the information of the Council a statement on the past and present condition of the Observatory, which was presented to the Council on the 11th December. In this statement it was shown that while the establishment at Kew Observatory received its main support from the British Association, and was under the control of that body, yet much of the apparatus in use at Kew was furnished from other sources. Thus, the Royal Society had from the Government-Grant Fund supplied the establishment with the apparatus for testing barometers, with that for testing sextants, with the dividing-machine for constructing standard thermometers, and also with the set of self-recording magnetographs at present in use, while from the Donation Fund they had furnished the photoheliograph and the Whitworth lathe and planing-machine. The Royal Society had likewise defrayed from the Donation Fund the expense of introducing gas into the Observatory, and of building a house for the verification of magnetic instruments, besides which they had borne from the Government-Grant Fund since 1863 the whole expense of working the Photoheliograph (including the purchase of a chronometer) and of reducing its results. The instruments used at Kew for determining the absolute magnetic elements are the property of Her Majesty's Government, and have been lent to the Kew Observatory by the Magnetic Office at Woolwich, under the direction of Sir E. Sabine, and many of those magnetic instruments with which Kew has been the means of furnishing scientific travellers have been derived from the same source. Of late Kew has become the central observatory of the Meteorological Committee, and a commodious workshop has been erected near the Observatory by that committee, since otherwise the main building would have been too small for the access of work consequent upon the arrangement entered into. The statement prepared by the Kew Committee contained likewise a summary of the scientific work done at the Observatory, as well as some interesting historical remarks connected with the origin of the establishment, drawn up by Sir C. Wheatstone, and in this shape it was submitted to the Council of the British Association. The Council then recommended "That the present existing relations between the Kew Observatory and the British Association be continued unaltered until the completion, in 1872, of the magnetical and solar decennial period, and that after that date all connection between them should cease." In consequence of this recommendation, the Kew Committee were led to contemplate the dissolution of the Kew establishment in 1872, and they became anxious to make such arrangements as might enable them to complete their scientific labours in a creditable manner before the time of the anticipated dissolution. The magnetic work in particular caused them anxiety; for the annual income of the establishment is insufficient to permit of that work being fully completed by the time of the annual meeting of the Association in 1872. Under these circumstances the chairman offered to supplement the deficiency. It will be seen by this report that the magnetical tabulations and reductions are now proceeding very fast. The recommendation of the Council was also a matter of anxiety to the superintendent, Mr. Stewart; and as the Professorship of Natural Philosophy at Owens College, Manchester, became vacant about this time, he applied for the appointment and was successful in obtaining it. This will render it necessary for Mr. Stewart to reside in Manchester, but the staff at the Observatory are such that Mr. Stewart will undertake by their aid to assist the committee in the superintendence of the work of the Observatory until 1872.

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* Berichte der Math. Phys. Classe der Kön. Sachs. Gesellsch. 1869, p. 352.

(A) WORK DONE BY KEW OBSERVATORY UNDER THE DIRECTION OF THE BRITISH ASSOCIATION.

1. *Magnetic Work.*—In the present state of magnetical science it would appear to be desirable to preserve as completely as possible the details of observations, so that future theorists may have a large and valuable source of information by which to test their speculations. The Committee are therefore desirous that by the autumn of 1872 a manuscript record should be completed, containing all the hourly tabulated values from the Kew Magnetographs arranged in monthly tables. This record should be carefully preserved, along with the original photographic traces, in the archives of the Association. Pursuing the method indicated by Sir E. Sabine, and adopting the separating values finally determined by him, the Committee further propose to obtain monthly results indicating the following points for each of the three magnetic elements, distributed according to the hour of the day:—

1. Aggregate of disturbance tending to increase the numerical values.
2. Aggregate of disturbance tending to decrease the same.
3. Solar-diurnal range of the undisturbed observations.

They suggest that the monthly results embodying these facts should be published in detail. Finally, they propose to continue the discussion of the lunar-diurnal variations commenced by Sir E. Sabine, and carried on by him up to the end of the year 1864. In order to work this scheme with sufficient rapidity to complete it before the autumn of 1872, additional assistance has been procured, the expense of which has been defrayed by the chairman. Mr. Whipple, magnetical assistant, has displayed much zeal and ability in organising the work and in superintending its immediate execution. Already the hourly numerical values of the three magnetic elements have been obtained and tabulated in monthly forms from the commencement of the series in 1858 to the present date; and considerable progress has also been made in the next step of the reduction. A unifilar, formerly employed by Captain Haig, and of which the constants have been determined at the Observatory, has been lent to Lieut. Elagin, of the Russian navy, for use in the Japanese seas and elsewhere. A dip-circle, by Dover, has been verified and sent to Prof. Jelinek, of Vienna, and another, by the same maker, has been verified for Dr. A. B. Meyer, for use in the East Indies. This gentleman has likewise received magnetic instruction at the Observatory. A dip-circle by Adie, furnished with a deflecting cylinder apparatus, has been verified and despatched to Prof. Bolzani, of the University of Kasan. Three dipping-needles have likewise been constructed for Dr. Bergsma, of Batavia, and one for Mr. Chambers, of the Colaba Observatory, Bombay. A deflection-bar has been procured and verified for the Russian Central Observatory. A declinometer has been sent to the Lisbon Observatory, and a Fox's circle has been lent to Dr. Neumayer, after having been repaired by Adie. The instrument devised by Mr. Broun for the purpose of estimating the magnetic dip by means of soft iron, and constructed at the expense of the British Association in pursuance of a resolution of that body passed at the Oxford meeting, has been forwarded to that gentleman at his request. The usual monthly absolute determinations of the magnetic elements continue to be made by Mr. Whipple, magnetic assistant. A paper embodying the results of the absolute observations of dip and horizontal force, made at Kew from April 1863 to April 1869, has been communicated by the superintendent to the Royal Society, and published in the "Proceedings" of that body. The results obtained evidence the accuracy with which the monthly observations have been made by Mr. Whipple. The self-recording magnetographs are in constant operation as heretofore, also under his charge; and the photographic department connected with these instruments remains under the charge of Mr. Page.

2. *Meteorological work.*—The meteorological work of the Observatory continues in the charge of Mr. Baker. Since the Exeter meeting, 150 barometers have been verified, and thirty have been rejected; 1,160 thermometers and 103 hydrometers have likewise been verified. Nineteen standard thermometers have been constructed for Prof. Tait, and two for the Meteorological Office. The self-recording meteorological instruments now in work at Kew will be again mentioned in the second division of this report. These are in the charge of Mr. Baker, the photography being superintended by Mr. Page.

3. *Photoheliograph.*—The Kew heliograph, in charge of Mr. Warren De la Rue, continues to be worked in a satisfactory manner. During the past year 351 pictures have been taken on 237 days. It was considered desirable that six prints should be obtained from each of the negatives of the sun pictures taken at the Observatory during the whole time that the photoheliograph should remain at work, which will probably be from February 1862 to February 1872. In order to accomplish this, an outlay of 120*l.* spread over two years was found to be necessary, and this sum has been voted from the Donation Fund of the Royal Society. A large number of these prints has already been obtained, and it is proposed to present complete sets to the following institutions:—

The Royal Astronomical Society,
The Imperial Academy of Paris,
The Imperial Academy of St. Petersburg,
The Royal Society of Berlin,
The Smithsonian Institution, United States,

leaving one set for the Royal Society. A paper embodying the positions and areas of the sun-groups observed at Kew during the years 1864, 1865, and 1866, as well as fortnightly values of the spotted solar area from 1832 to 1868, has been communicated to the Royal Society by Messrs. Warren De La Rue, Stewart, and Loewy. This paper is in course of publication in the "Philosophical Transactions," and will shortly be distributed. A table exhibiting the number of sun-spots recorded at Kew during the year 1869, after the manner of Hofrath Schwabe, has been communicated to the Astronomical Society, and published in their monthly notices. M. Otto Struve, director of the Imperial Observatory at Pulkowa, visited England in the month of August last. He brought with him, for the Kew Observatory, some sun-pictures made at Wilna with the photoheliograph, which, it will be recollected was made some years ago, under the direction of Mr. De La Rue, by Mr. Dallmeyer. This instrument combines several important improvements on the original Kew model, the value of which is forcibly brought out in the superior definition of the Wilna sun-pictures. As, however, the series of the ten-yearly record at Kew was commenced with the instrument as originally constructed, it was not deemed desirable to alter it in any way until the series had been completed and reduced, and the corrections for optical distortion ascertained and applied. In the event of the sun-work being continued after 1872, it will be desirable to do so with a new and improved heliograph. M. O. Struve proposed to exchange the complete series of pictures obtained at Wilna for that made at Kew. He also stated that it is contemplated to erect a second heliograph at the Central Observatory at Pulkowa.

4. *Miscellaneous Work.*—A few experiments have been made on the rotation of a disc *in vacuo*. By an arrangement devised by Mr. Beckley, a very perfect carbonic-acid vacuum has been obtained, the residual pressure being 0·02 inch as indicated by a mercurial gauge with a contracted tube, but it was believed that the vacuum was even more perfect. A disc of paper and one of ebonite gave very sensible heat effects in such a vacuum, and it was hoped that the experiments might have been satisfactorily completed; but while they were in progress the pressure of the outer atmosphere shattered the receiver into a number of pieces, fortunately without any injury to the experimenters. Another receiver has now been made, and it is purposed in future to use it with a cover. A transit instrument has been lent to Mr. G. J. Symons, and one sextant has been verified.

(B) WORK DONE AT KEW AS THE CENTRAL OBSERVATORY OF THE METEOROLOGICAL COMMITTEE.

It is stated in the report for 1867 that the Meteorological Committee had appointed Mr. Balfour Stewart as their secretary, on the understanding that he should, with the concurrence of the Kew Committee, retain his office of Superintendent of the Kew Observatory. On the 8th October, 1869, Mr. Stewart resigned his appointment as Secretary to the Meteorological Committee and Director of their Central Observatory—a step which took effect on the 31st of March, 1870, and which was followed by a modification of the relation between the two committees. The Meteorological Committee, at their meeting on 12th November, 1869, resolved that they were prepared to make the following proposals to the Council of the British Association:—

I. That Kew be continued as one of the ordinary self-recording observatories, in which case the committee would be prepared to allot to it annually 250*l.*; or,

II. In addition to the foregoing work, that Kew be maintained as the central observatory for examination of records and tabulations from all the other observatories, in which case the committee will be prepared to allot a further annual sum of 400*l.* The Kew Committee, having been furnished with this resolution of the Meteorological Committee, resolved that it be recommended to the Council of the British Association that Kew be continued for the next two years as one of the ordinary self-recording observatories of the Meteorological Committee, that body allowing it annually 250*l.*; and that, in addition, it be maintained as the central observatory for the examination of the records and tabulations from all the other observatories, for the further sum of 400*l.* per annum. This arrangement was approved by the council; and it was thereupon resolved by the Kew Committee, that out of the 650*l.* received from the Meteorological Committee, 200*l.* be given to Mr. Stewart for superintending the meteorological work of the Observatory, this resolution to take effect after 31st March, 1870.

1. *Work done at Kew as one of the Observatories of the Meteorological Committee.*—The barograph, thermograph, and anemograph furnished by the Meteorological Committee are kept in constant operation. Mr. Baker is in charge of these instruments. From the first two instruments traces in duplicate are obtained, one set being sent to the Meteorological Office and one retained at Kew; as regards the anemograph, the original records are sent, while a copy by hand of these on tracing-paper is retained. The tabulations from the curves of the Kew instrument are made by Messrs. Baker, Page, and Foster.

2. *Verification of Records.*—The system of checks devised by the Kew Committee for testing the accuracy of the observations made at the different observatories continues to be followed, the only alteration being that the Kew staff, at the suggestion of the Meteorological Office, have undertaken to rule on the barograms and thermograms a set of zero lines, which are of great use in pantagraphic operations. Mr. Rigby continues to perform the main part of this work; Mr. Baker, Meteorological Assistant, having the general superintendence of the department.

3. *Occasional Assistance.*—The Meteorological Committee have availed themselves of the permission to have the occasional services of Mr. Beckley, Mechanical Assistant at Kew; and he has lately been visiting the various observatories of the Meteorological Committee. The self-recording rain-gauge mentioned in last report as having been devised by Mr. Beckley has been adopted by the Meteorological Committee, and instruments of this kind are at present being constructed for their various observatories. The staff at Kew continue to make occasional absolute hygrometrical observations by means of Regnault's instrument, with the view of testing the accuracy of the method of deducing the dew-point from the observations with the dry and wet bulb thermometers. Two erections have been made in the grounds adjoining the Observatory, and on one of these a large Robinson's anemometer is placed, while a small instrument of the same kind is placed on the other. By this means the indications of the large and those of the small-sized instrument may be compared with each other. The cost of this experiment has been defrayed by the Meteorological Committee.

J. P. GASSIOT, Chairman

Kew Observatory, Sept. 9, 1870

SCIENTIFIC SERIALS

THE November number of the *Geological Magazine* (No. 77) opens with an article by the editor, Mr. H. Woodward, on Fossil Crustacea from various formations. The species described and figured by the author are *Scyllaridia bellii* from the London clay of Sheppey, and *Palæga carteri* from the lower chalk. One of the most important papers in the number is on the coal-bearing rocks of Southern Chile by MM. Lebour and Mundle. The coal appears to be only a kind of lignite; it is found in beds of tertiary age. Mr. Lucy contributes a paper on the Post-pliocene Drift of Charnwood Forest; Mr. H. F. Hall, a note on the Glacial and Post-glacial deposits in the neighbourhood of Llandudno; Mr. L. C. Miall, a paper on the formation of swallow-holes in mountain limestone; and Mr. E. Wilson, a notice of some altered clay-beds and sections in Tideswell Dale, Derbyshire. The remainder of the number is occupied as usual by reviews, notices, and miscellaneous matter.

THE October number of the *American Naturalist* (vol. iv., No. 8) is chiefly devoted to Geological and Archæological subjects. It opens with an address on recent advances in Geology, delivered by Mr. J. H. Foster to the American Association for the Advancement of Science, and contains also a paper on the Primitive Vegetation of the Earth by Dr. J. W. Dawson, and a note on Indian Stone Implements by Mr. J. H. Gregory. The only other paper is a short note on bud-variations in the colour of the flowers in *Trillium* and *Wisteria*. This number also contains an interesting illustrated report of the nineteenth meeting of the American Association, including a valuable paper by Dr. A. S. Packard, jun., on the embryology of *Limulus polyphemus*; and another, by Prof. E. D. Cope, on the Structural Characteristics of the Cranium in the Lower Vertebrata.

Proceedings and Communications of the Essex Institute.—The first part of volume vi. was published in the spring of this year. Of four papers given in it, three relate to entomological subjects; these are descriptions (with figures) of numerous species of ants from Mexico, by Mr. Edward Norton; an excellent monograph of the Phalangea (Harvest Spiders) of the United States, by Dr. Horatio C. Wood, also illustrated; and an important notice of insects inhabiting salt water, by Dr. A.